JRC Newsletter

EUROPEAN COMMISSION

January 2009

Editorial

In science, as with most things in life, it's amazing what we can achieve when we work together. My experience of nuclear research has been that we need only apply ourselves in concert to uncover the infinite, minuscule mysteries of the universe.

The 'Karlsruhe Chart of Nuclides' was drawn up in 1958 by scientists at the *Kernforschungszentrum*, an erstwhile German nuclear research centre in Karlsruhe where the European Commission's Joint Research Centre today has its Institute for Transuranium Elements (ITU).

For fifty years now the Nuclide Chart has provided scientists and students all over the world with invaluable, precise and structured information on the half-lives of radionuclides, on the ways in which they decay and on the energy contained in the radiation they emit. Playing a role equivalent to that of an elaborate periodic table, the chart is used today everything from health physics and radiation protection to nuclear- and radio-chemistry, astrophysics, medicine, biology, agriculture, geology and more.

A nuclide is what we call a stable or unstable atom characterised by the number of protons and neutrons in its nucleus. All isotopes of an element contain the same number of protons in the nucleus but different numbers of neutrons. A nuclide chart offers a detailed description of a given element's radioactive attributes and its isotopes, providing a unique overview of current knowledge in nuclear science.

Edited by Walter Seelmann-Eggebert and Gerda Pfennig at the *Forschungszentrum Karlsruhe*, the 1958 edition contained information on approximately 1,300 nuclides grouped into 102 chemical elements.

Since then, more than 1,650 new nuclides have been discovered and more than a dozen new elements have been identified. New decay modes, the ways in which energy is emitted through radiation, have also been discovered: we know now, amongst other modes, about proton decay, cluster emission or double-beta decay, which lasts for billions of years.

JRC-ITU has officially managed the Chart since 2006 and is responsible for the development of further editions. The Chart now contains information on nearly three thousand experimentally observed nuclides. Theoretical estimations point to the existence of at least six thousand.

ITU has also launched a commemorative publication to mark the 50th Anniversary of the *Karlsruher Nuklidkarte*. The book provides a broad overview of scientific research in nuclear science.

This event also marks a milestone on our journey to map out the nuclear landscape: it may require another fifty years to complete the nuclide chart. But to have thus plotted the entirety of the elements and their isotopes, completing our voyage of discovery to return with new knowledge that may yet benefit humanity in ways as yet unknown to us, is surely an endeavour in which we must persevere. (And yes, we can.) As our scientists continue on their journey we look forward to further editions of the *Nuklidkarte* and the many exciting discoveries that surely lie ahead for future generations.

Professor Antonino Zichichi
President of the World Federation of Scientists

Climate change: impact assessment of EU proposals for Copenhagen

On 28 January, the European Commission presented its Communication "Towards a comprehensive climate change agreement in Copenhagen". The Communication represents its latest proposals ahead of the 2009 UN Climate Conference, to be held in Denmark in December. Agreement in Copenhagen should be the basis for further international action on climate change, following on from the Kyoto Protocol's first commitment period, which ends in 2012.

The JRC Institute for Prospective Technological Studies (IPTS) assessed the impacts of the Commission's new proposal using POLES, the Commission's world simulation model for the energy sector, as well as the macroeconomic General Equilibrium Model for Energy-Economy-Environment interactions (GEM-E3). The analysis focuses on alternative post-2012 burden sharing scenarios on a global scale, as well as on the role of global carbon markets.

Climate change: EU outlines its options for Copenhagen

The analysis addresses impact on gross domestic product, employment, trade, government revenues, household consumption and energy use.

The Commission's Communication sets out concrete proposals for action by the EU and the rest of the international community with the aim of limiting global average temperature rise to less than 2°C above pre-industrial levels, along with effective financial architecture to support the actions to be agreed on in Copenhagen.

http://en.cop15.dk/

Reporting on major accidents in Europe: eMARS

MAJOR ACCIDENT HAZARDS BUREAU

As part of a new online system developed by the JRC for reporting on major accidents in Europe, the European Commission decided in December 2008 upon the use of a new report form to be used by national authorities in cases of major accidents in the EU. 'Major accidents', involving for example hazardous substances, are those whose consequences are widespread, potentially affecting more than one country.

The online system, entitled *eMars* (Major Accident Reporting under Seveso II), was developed by the JRC Institute for the Protection and Security of the Citizen (IPSC) for reporting on accidents and disseminating lessons learned from them. The initiative comes in the context of the Seveso II Directive, which aims to promote the exchange of information among EU Member States on accidents and 'near-misses'.

eMars is based on the JRC's longstanding experience in accident reporting and evaluation as well as extensive preparatory work in consultation with Member States. The system marks an important step forward in improving the quality of accident reporting and in facilitating the dissemination of lessons learned, in turn helping to prevent the occurrence of similar accidents in the future.

http://mahbsrv.jrc.ec.europa.eu/

Alternatives to animal testing: JRC approves two new *in vitro* methods

The European Centre for the Validation of Alternative Methods (ECVAM), part of the JRC Institute for Health and Consumer Production (IHCP), finalised the evaluation and validation of two further *in vitro* test methods for chemical substances using human skin cells in late December 2008.

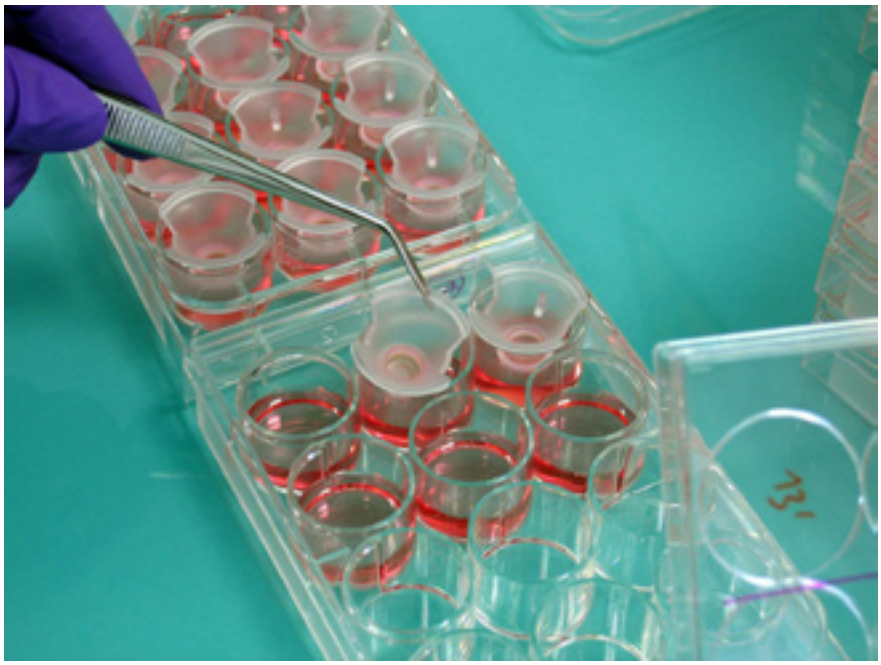
As consumers, we assume that the chemical substances such as cleaning products and cosmetics that most of us use on a daily basis are safe and will not cause irritation or damage to our skin. Chemical ingredients used in such products are thus thoroughly tested for their safety before being marketed, usually through testing on the skin of rabbits. But animal testing is not only ethically problematic; it is

also based on a subjective 'scoring' of adverse effects, rather than on the empirical measurement using defined parameters. Rabbit skin also differs substantially from our own.

The newly validated *in vitro* methods, entitled SkinEthic RHE and EpiDerm SIT, are capable of distinguishing reliably between harmless substances and those that cause irritation to human skin without recourse to animal tests.

Along with the EPISKIN test validated last year, there are now three ECVAM-validated *in vitro* skin models available. Testing on rabbits for skin irritation may soon be considered obsolete.

ECVAM was created by the European Commission in 1991 to seek alternatives to using animals for experimental and other scientific purposes, stating that "an experiment shall not be performed if another scientifically satisfactory method of obtaining the result sought, not entailing the use of an animal, is reasonably and practicably available".



Commercial artificial human skin test

http://ihcp.jrc.ec.europa.eu/about_us/in-vitro-toxicology.htm

JRC trains UN nuclear inspectors in power plant design verification

Scientists from the JRC Institute for the Protection and Security of the Citizen (IPSC) have been training inspectors from the International Atomic Energy Agency (IAEA) in the use of its 3D-DIV (Design Information Verification) systems, developed for use by nuclear inspectors to verify that nuclear installations have been built according to their declared designs.

Based on 3D laser technologies and software, the 3D-DIV system is capable of creating a geometric model (accurate to within one millimetre) of a complex facility, detecting any changes in the facility and integrating 'safeguards' data for easy presentation and interpretation. A total of 33 IAEA inspectors have now been trained in use of the system.

Also in December, the JRC delivered a laser mapping system for verification of radiation containment to the IAEA.

For nearly three decades the JRC has provided technical assistance and equipment to the IAEA in order to allow the UN's 'Nuclear Watchdog' to verify that nuclear materials are used for peaceful purposes only.

http://ipsc.jrc.ec.europa.eu/showaction.php?id=36

Completion of project on food contact materials

The JRC's contribution to the FOOD-MIGROSURE project was completed in December 2008. The project's aim is to provide a mathematical tool for the estimation of consumer exposure to chemicals entering food from the packaging in which it is kept (migration from contact materials).

The role of the JRC Institute for Health and Consumer Protection (IHCP) in the project involved the provision of analytical data on the kinetics of migrant chemicals in two dozen foodstuffs at different temperatures. It also coordinated a work package on the social acceptance of safety of packaging, using focus groups and questionnaires. The JRC also organised the project's closing conference, attended by over 140 representatives of industry, health regulation enforcement and academia.

The project resulted in the compilation of comprehensive data on the migration of a wide range of substances from packaging materials into various foodstuffs. This in turn is being used in recent revision of EU legislation laying down the list of simulants – representing a near infinite array of foodstuffs – used for testing articles intended to come into contact with food of every kind.

http://crl-fcm.jrc.ec.europa.eu/

Ecological Water Quality Assessment and Intercalibration

The European Commission's Decision on laboratory intercalibration, published in December in the EU's Official Journal, is a direct result of four years' work by the JRC Institute for Environment and Sustainability (IES) on ecological water quality assessment and intercalibration (EEWAI) in support of the EU's Water Framework Directive and its implementation across Europe. Intercalibration is the state achieved by a group of laboratories in which they produce and maintain compatible data outputs.

The JRC's EEWAI action plays an important role in research on the ecological assessment of Europe's aquatic ecosystems, for example in the areas of climate change, phytoplankton indicators in coastal waters, lake macroinvertebrates, gene responses to environmental stressors and microbial biodiversity.

http://ies.jrc.ec.europa.eu/index.php?page=81

♦♦

The long-term safety of uranium mining and mill-tailings in an enlarged EU

The JRC Institute for Energy (IE) completed a report for the European Commission's Directorate General for Energy and Transport in November in preparation for a Communication from the Commission to the European Parliament. The report analyses the long term safety of uranium mining and its legacies such as uranium mill-tailings, in an enlarged EU.

The Communication will serve as the basis for actions and recommendations envisaged in 2009 to further improve the safety and sustainability of new and existing uranium mining activities and to ensure the effective long-term management of uranium mining legacies in EU Member States.

http://ie.jrc.ec.europa.eu/

SCIENTIFIC RESULTS

The JRC Exploratory Research Symposium 2008

The 2008 edition of the JRC Exploratory Research Symposium was held in Ispra on 17 December. JRC Director-General Roland Schenkel introduced examples of the exploratory research from each of the JRC's seven institutes, which included work carried out on allergen detection, imagery analysis, the properties of metal alloys in nuclear fuel, diesel exhaust nano-particle dynamics, the conversion of *syngas* to hydrogen and storage-ready carbon dioxide, amino-acids in equilibrium plasma and advances in *Mobile 2.0*.

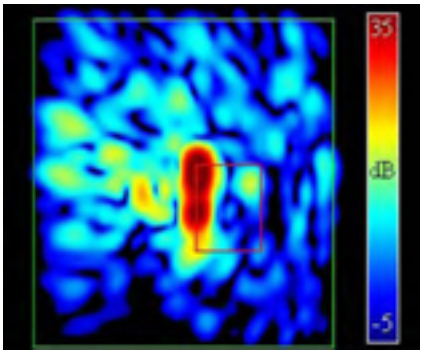
Exploratory research seeks to develop new knowledge in areas where little information exists or where expertise is lacking. It is curiosity driven and while it carries some risk, it can help organisations such as the JRC anticipate its customers' scientific and technical needs and lead to exciting new areas of research. It also provides opportunities to seek recognition for one's work, contributing to researchers' motivation.

In order to assure sound scientific support for future policy decisions and to strengthen its scientific base, the JRC invests approximately 6% of its annual institutional budget in exploratory research. The diversity of projects, fields and methods that arise from this funding, together with the enthusiasm of the scientists involved, assure that every year in December the Exploratory Research Symposium is a forum for genuine, sometimes groundbreaking research.

The work presented at the JRC Exploratory Research Symposium 2008 was as follows:

Virginie Tregoat, Linda Monaci and Arjon van Hengel from the JRC Institute for Reference Materials and Measurements (IRMM) presented their work on **proteomic and immunochemical approaches to the detection of allergenic peptides in milk.**

Dominik Brunner and Guido Lemoine from the JRC Institute for the Protection and Security of the Citizen (IPSC) presented their **3D reconstruction of buildings and damage assessment** following armed conflicts and natural disasters using data extracted from **Very High Resolution (VHR) Synthetic Aperture Radar (SAR) imagery.**



Main scattering mechanisms of buildings in SAR, first phase: db-power image from EMSL experiment on scale model

Vincenzo Rondinella from the JRC Institute for Transuranium Elements (ITU) presented his work on the **properties of 4d metal alloy particles in spent nuclear fuel.**

Another demonstration of exploratory research activities came from Lorenzo Isella, Yannis Drossinos and Barouch Giechaskiel from the JRC Institute for Environment and Sustainability (IES) with their work on the **modelling of diesel-engine exhaust nano-particle dynamics.**

Jan Rogut from the JRC Institute for Energy (IE) explained his work on novel **integrated processes for on-site conversion, separation, purification and compression of syngas into fuel-cell-quality hydrogen and storage-ready carbon dioxide.**

Hubert Rauscher, Ondřej Kylián and Francois Rossi from the JRC Institute for Health and Consumer Protection (IHCP) gave a presentation of their research on the **deposition of amino-acid micro-arrays and their modification and removal using plasma discharges**, with a view to more effective sterilisation of medical equipment.

Finally, Claudio Feijoo, Ioannis Maghiros, Fabienne Abadie, Margherita Bacigalupo, Ramón Compañó, Wainer Lusoli and Corina Pascu from the JRC Institute for Prospective Technological Studies (IPTS) presented their research on **"breaking the walls of Mobile 2.0"**, exploring the challenges for Europe in its **response to global competition in the mobile telecommunications industry.**

Having agreed that the symposium should have more visibility outside of the JRC and that members of the research community from beyond the European Commission should be invited to participate, the JRC plans to expand the role of the Exploratory Research Symposium, along with that of its annual Excellence Awards (see the previous edition of this newsletter) in the near future.

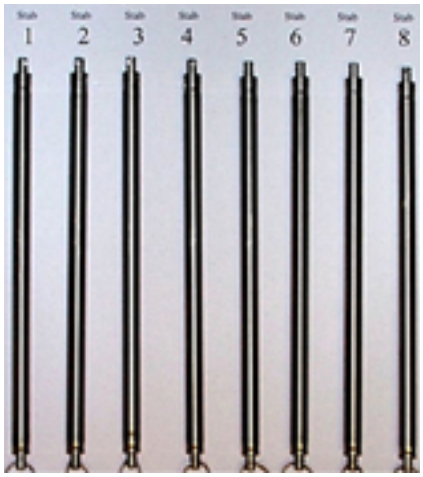
http://www.jrc.ec.europa.eu

Uranium fuel rod crash tests

The first ever crash tests on segments of spent Uranium Dioxide (UO_2) fuel were carried out by nuclear scientists at the JRC Institute for Transuranium Elements (ITU) in Karlsruhe, Germany in November.

The tests, conducted at ITU's 'hot cells' facility, involved dropping a block of steel weighing 5.5 kg from a height of one metre onto a 20cm long fuel rod secured at each end by a vice. It was found that with increased 'burn-up', the fuel rod became more brittle than predicted. This was attributed largely to a phenomenon known as hydrogen pick-up during irradiation.

Crash tests on highly radioactive materials are scarce and only possible in a very limited number of facilities. The tests performed at ITU have aroused keen interest from the applied nuclear research community.



Light water reactor (LWR) fuel pins

http://itu.jrc.ec.europa.eu/index.php?id=30

Modelling the environmental load of nitrogen

The JRC has developed a modelling approach that allows the quantification of nitrogen emission diffused into surface water. The research, carried out by Bruna Grizzetti and Faycal Bouraoui, scientists at the JRC Institute for Environment and Sustainability (IES), along with Ghislain De Marsily from the Université Pierre et Marie Curie in Paris, has been published in the journal *Global Biogeochemical Cycles*.

The new modelling approach also allows the assessment of contributions from different sources to total nitrogen contamination of rivers and the estimation of nitrogen retention in river systems across Europe.

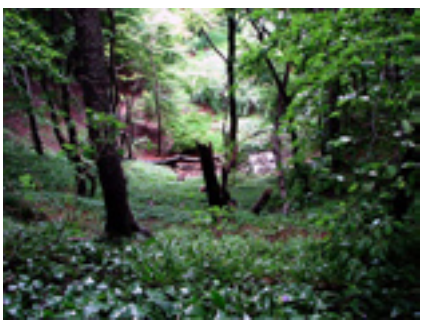
The publication is available here: http://www.agu.org/pubs/crossref/2008/2007GB003085.shtml

RECENT AND FORTHCOMING EVENTS

European Forest Data Centre workshop

On 4-5 December 2008 the JRC Institute for Environment and Sustainability (IES) hosted the first FOREST (Forest Data and Information Systems) workshop with the aim of further developing the European Forest Data Centre (EFDAC) and in order to support the implementation of the European Shared Environmental Information System (SEIS).

Specialists from 23 countries participated in the workshops alongside international organisations such as the UN Economic Commission for Europe (UN-ECE) and the European Commission's Directorates General for Environment and for Agriculture. The workshop consolidated the EFDAC network and demonstrated the integration of JRC systems offering forestry-related information such as the *European Forest Fire Information System* (EFFIS) and the *European Forest Information and Communication Platform*.



Information on forests is essential for implementing EU environmental policies

http://forest.jrc.ec.europa.eu/

JRC Information Day in France

As part of the ENERGAÏA international renewable energies exhibition and conference in Montpellier, the JRC hosted an Information Event on 11 December 2008 with the theme "European contribution to low carbon energy research - a special focus on the activities of the European Commission's Joint Research Centre".

ENERGAÏA 2008 exhibition: a showcase of the renewable energies industry

Scientists from the JRC Institute for Energy (IE) organised seminars dedicated to solar electric power, with presentations of the JRC's activities in photovoltaic (PV) energy and on recent studies examining the effectiveness of solar tracking systems that follow the movement of the sun. The JRC also had a stand at the exhibition

The JRC at ENERGAIA 2008

and presented its activities in the hydrogen and fuel cells field in joint sessions with partner organisations N.ERGHY, the Centre national de la recherche scientifique (CNRS), the Institut Charles Gerhardt, Laboratoires Promes, the Académie des technologies and the Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME).

The event was opened by Yves Piétrasanta, Vice President of the French Languedoc-Roussillon region.

This was the second edition of ENERGAÏA and the event brought together 304 exhibitors from 15 countries in every sector of renewable energies industry, from solar and wind energy to geothermal heathing and eco-building. It was attended by over 20,000 industry professionals and members of the public.

http://www.jrc.ec.europa.eu/info-day-france-2008

UPCOMING

IAEA International Symposium on Nuclear Security

Vienna, Austria, 30 March-3 April

The International Atomic Energy Agency (IAEA) is organising a symposium on advances and recent achievements in global efforts to enhance the security of nuclear and radioactive materials. Its aim is to identify areas for further improvement and efforts necessary to achieve this. The JRC Institute for Transuranium Elements (ITU) is participating in the symposium.

Policy makers and experts will convene at the event to share knowledge and information on implementing the nuclear security framework and to identify the best way forward to achieve a sustainable, enhanced global nuclear security regime, with specific proposals to be considered for the IAEA 2010-2013 Nuclear Security Plan.

Event website:
http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=36576

Use of reference materials and estimation of measurement uncertainty

Geel, Belgium, 6-7 May

The JRC Institute for Reference Materials and Measurements (IRMM) will host a training course in May 2009 with the aim of providing a theoretical basis for the estimation of measurement uncertainty and the establishment of traceability. The course is intended for laboratory managers and practitioners in analytical laboratories who use reference materials for statistical quality control, method validation and calibration.

http://www.irmm.jrc.be/html/training/index.htm

50 years of the JRC in Ispra: Open Day 2009

Ispra, Italy, 16 May

On 16 May 2009 the JRC site in Ispra will again open its doors to the public. After the highly successful Open Day in 2007 with almost 8,000 participants, the 2009 Open Day promises to be even bigger and better, especially given that this year marks the fiftieth birthday of this JRC site. The day's programme will give more exposure to interesting laboratories with more interactive experiments as well as lively presentations, shows and entertainment for all age groups. Once again, a special programme with scientific games and quizzes will be prepared for children.
http://www.jrc.ec.europa.eu/ispra-openday-2009

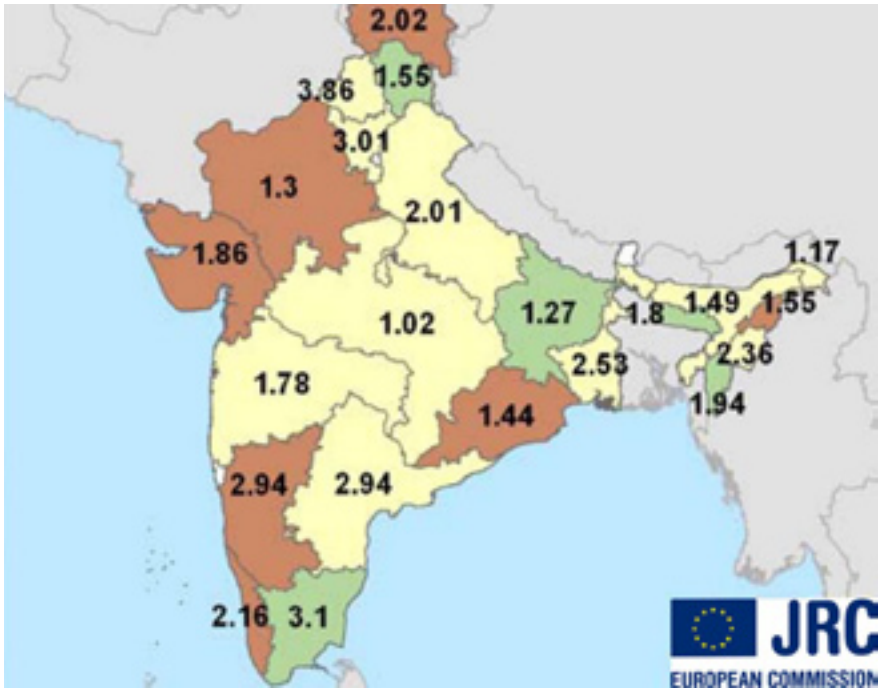
International cooperation in crop monitoring

The JRC has published the first ever *India Rice Bulletin*, targeting quantitative rice yield forecasts at state level for India. Produced by the JRC Institute for the Protection and Security of the Citizen (IPSC) and its AGRI4CAST team, the bulletin is the latest in a series of existing annual publications including the European Rice Bulletin, the China Rice Bulletin, the MARS Crop yield forecast for Europe and the European Pasture Bulletin.

The India Rice Bulletin will be issued twice yearly. Crop growth simulation, agro-meteorological analysis, yield forecasts and remote sensing analysis are carried out in-house by JRC scientists to produce the bulletins, with area statistics taken from sources available to the public.

Also this month, in the framework of a collaboration agreement with Morocco's National Agronomic Research Institute (INRA), the AGRI4CAST team has successfully installed a Crop Growth Monitoring System (CGMS) at INRA premises in Settat, Morocco. The INRA team can now begin crop growth modelling and further build upon their databases. It is expected that this will lead to the publication of common agricultural bulletins in the future.

http://mars.jrc.ec.europa.eu/mars/About-us/AGRI4CAST



2008 rice yield forecast for India: actual yield versus 2005/06, t/ha, lower(red) to better (green)

JRC TEMPEST laboratory accredited by UKAS

The JRC's Thermal, Electro-Magnetic, Physical Equipment Stress Testing (TEMPEST) laboratory at the Institute for the Protection and Security of the Citizen (IPSC) has been accredited in conformance with the ISO/IEC 17025:2005 standard by the United Kingdom Accreditation Service UKAS.

The TEMPEST laboratory performs qualification tests on electronic equipment used for animal identification and traceability of animals and animal produce. The same tests may be applied to similar devices in the context of nuclear safeguards or agriculture.

Thermal tests involve the use of climate chambers capable of reproducing a large range of environmental conditions while electromagnetic immunity tests consist of the reproduction of disturbances and discharges due to magnetic and electrostatic fields. Mechanical stress tests include low, medium and high frequency vibrations, shock and drop tests.

http://ipsc.jrc.ec.europa.eu/facility.php?id=tempest

TEMPEST laboratory: climate chambers for environmental testing

JRC signs crop forecasting agreement with Ukraine

JRC-IPSC has signed a collaboration agreement with Ukrainian authorities on joint crop yield forecasting activities.

Yevgen Ignatenko, Head of Division for European and International Integration at the Ukrainian Ministry of Agricultural Policy and Volodymyr Kravchuk, Director of the L. Pogorily UkrNDIPVT Foundation, visited JRC-IPSC for the signing of the agreement on 18 November 2008 and in order to discuss technical issues related to common crop yield forecasting.

http://ipsc.jrc.ec.europa.eu/

50 years of the Karlsruhe Nuclide Chart

To celebrate the fiftieth anniversary of the *Karlsruher Nuklidkarte*'s publication on 9 December 2008, the JRC Institute for Transuranium Elements (ITU) in Karlsruhe hosted selected guests including Members of European Parliament, politicians and Nobel prizes laureates for a discussion of its history and use since 1958. The event also served as the launch of a book especially prepared for the occasion.

Further information on the Chart and on the purchase of the book is available online at: www.karlsruhenuclidechart.net

New design for JRC-ITU buildings

JRC-ITU has selected the architects that will oversee construction of its new office buildings. A technical committee consisting of a panel of architects and representatives from both the JRC and *Forschungszentrum Karlsruhe* evaluated seventeen proposed projects and a range of innovative designs before selecting MGF Architekten GmbH from Stuttgart in December 2008.

The jury awarded the first prize to a project that they felt perfectly integrated the new building with the existing structure and character of the institute. The design offers space for offices, meeting rooms and social areas. The project also offers flexibility for modifications upon request.

http://itu.jrc.ec.europa.eu

JRC-ITU: Plans for new facilities

The JRC Newsletter is a monthly publication intended to provide JRC customers, stakeholders and other interested parties with an overview of recent highlights from the JRC's scientific achievements, policy support, contributions to events and other news.

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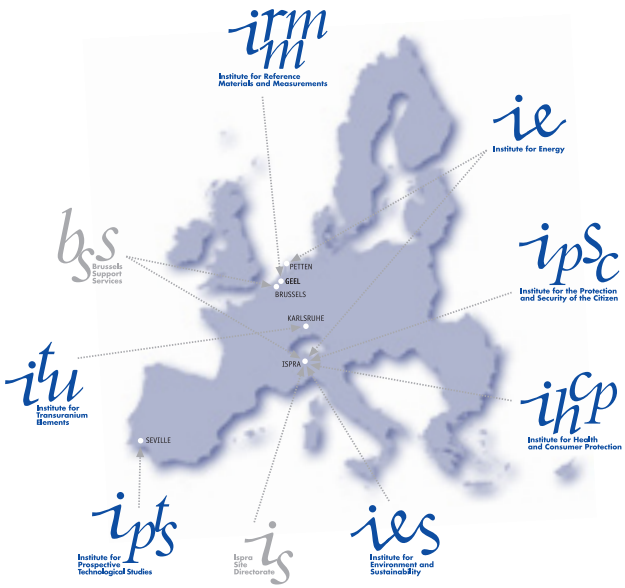
Picture credits
p. 2: Ice floes near Mendenhall Glacier, Alaska (Paul Caputo)
p. 6: ENERGAÏA 2008



The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.